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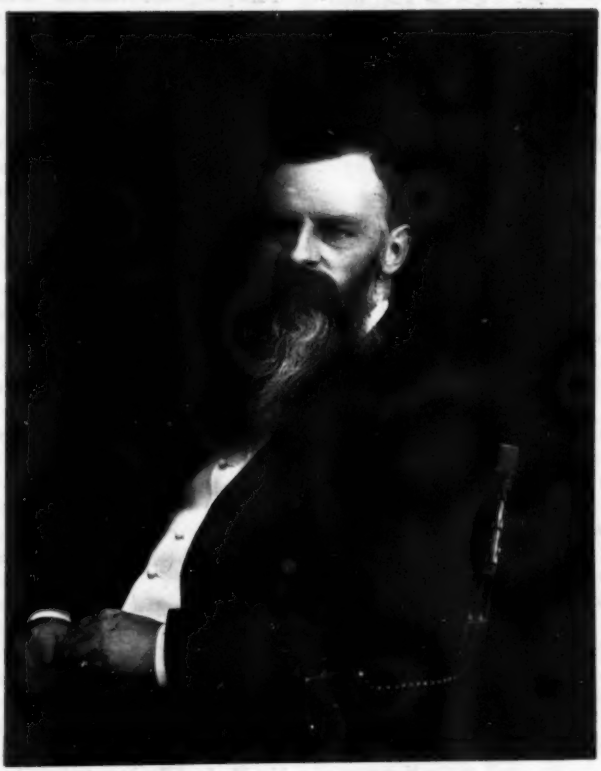


LATIMER CLARK, C.E.

PAST PRESIDENT OF THE SOCIETY OF TELEGRAPH ENGINEERS.

MR. LATIMER CLARK, whose photograph by Messrs. Mayall we herewith present to our readers, was born at Great Marlow in 1822. In early life he studied chemistry, and for some time practised as a scientific and manufacturing chemist, in which capacity he had entire charge of an extensive business in Dublin. The railway mania of 1845 induced him to engage in railway surveys, and in 1848 he was engaged under the late Robert Stephenson at the Britannia Bridge, as assistant resident-engineer; his brother, Mr. Edwin Clark, being resident-engineer. This position he filled until 1851, having during the time very responsible duties to perform. In the course of this work he narrowly escaped losing his life by the bursting of an hydraulic press, under which he was standing.

During the construction of the bridge the works

were frequently visited by men interested in science, and amongst others by Mr. S. L. Ricardo, the founder of the Electric Telegraph Company. The Messrs. Clark, always fond of scientific recreations, had established an eight-o'clock time-gun, fired by voltaic electricity; and to this apparently trivial circumstance may be traced their more intimate acquaintance with Mr. Ricardo, who, in 1850, appointed Mr. Edwin Clark engineer-in-chief, and Mr. Latimer Clark assistant-engineer to the Electric Telegraph Company. In 1854, Mr. Edwin Clark resigned, and Mr. Latimer Clark became engineer-in-chief—a position which he held until 1861; from which time until the transfer of the telegraphs to the Post-office he had a retaining fee from the Electric Telegraph Company as consulting engineer. During this period he was enabled to render much assistance to the Astronomer-Royal in the electrical arrangements for the determination of the longitudes of various places and the distribution of Greenwich time.

In 1853 he made many original researches on the subject of electric currents through underground telegraph wires laid between London, Leeds, and Liverpool. In the course of these experiments he was the first to witness experimentally the retardation of the electric current in subterranean lines, and, at the request of the Astronomer-Royal, Professor Faraday, and Professor Melloni, he showed experimentally "that currents of low tension travelled with the same velocity as currents of high tension." His experiments were repeated before Professor Faraday, and formed the subject of a lecture at the Royal Institution in January, 1854. From this circumstance these researches are generally supposed to be Faraday's experiments on subterranean lines.

In 1854 he introduced the pneumatic system for the transmission of messages, now extensively employed; and in 1857 he became engineer, in conjunction with Mr. Rammell, to the Pneumatic-Dispatch Company, who laid down a system of lines from Euston Station to Holborn and the General Post-office. In 1856 he patented the double-cup insulator which is extensively used; and in 1858 he patented the now well-known method of preserving submarine cables from rust, by a covering of asphalte hemp and silica.

In 1859, after the failure of the 1858 Atlantic Cable, Mr. Clark was appointed engineer to the Atlantic-Telegraph Company, but no practical steps were taken by this Company for several years, owing to the want of confidence in submarine cables caused by the failure of the cable of 1858.

In 1860 he was appointed a member of the "Joint Committee appointed by the Board of Trade and the Atlantic-Telegraph Company to inquire into the construction of submarine cables," and he had the management of many of the investigations. In 1861 he resigned his position as engineer to the Electric-Telegraph Company, and entered into a partnership with Sir C. Bright; and in that year he drew attention to the necessity of adopting fixed standards of electrical quantity, tension, &c., in a paper read at the British Association, in which he proposed the well-known names "Ohm," "Farad," "Volt," &c., since adopted, and afterwards became a member of the Committee on Electrical Standards. In 1862 Messrs. Bright & Clark were entrusted by the Indian Government with the engineering supervision of the construction and laying of the Persian Gulf Cable; and, amongst other work for these operations, a careful series of experiments were made by the Firm on the effect of temperature on the conductive resistance of gutta percha. These experiments, which are described in a paper read by Sir C. Bright before the Institution of Civil Engineers on "The Telegraph to India," form the basis of the tables employed by electricians up to the present day.

After the cessation of the partnership with Sir C. Bright, in 1866, Mr. Clark was engaged as engineer for several Submarine Telegraph Companies, sometimes in conjunction with other engineers—as in the French Atlantic—and sometimes alone, as in the second Persian Gulf Cable. When going out to India on this expedition in 1869, he was on board the steamship *Carnatic* when she was wrecked on the island of Shadwan, in the Red Sea, when thirty lives were lost, and Mr. Clark had his collar-bone broken, and narrowly escaped being drowned.

He has been for some years now associated with Mr. Forde, and later with Mr. Hockin and Mr. Herbert Taylor; and, under the title of Clark & Forde, this firm—of which Mr. Clark is the head—has superintended, on the part of the Telegraph Companies, the manufacture and laying of nearly all the long lines laid by the Telegraph-Construction Company, including the 1873 and 1874 Atlantic cables, the Eastern Telegraph Company's cables between England, Portugal, Egypt, and India; the Eastern Extension Company's cables between India, China, Australia, and New Zealand, and the cables of the Brazilian Submarine Telegraph Company between Portugal and Brazil. He is also a member of the well-known firm of Warden, Muirhead, and Clark, electric telegraph engineers.

Mr. Clark has not confined his labours to tele-

graph engineering, but has of late years been connected with several patented inventions of considerable importance, the chief being a new form of floating-dock, and is at the present time constructing, in partnership with Mr. Standfield, for the Russian Government, one of these docks for the special accommodation of the circular ironclads of the Russian Navy.

Mr. Clark's literary labours date from 1849, in which year he published a small book entitled, "Description of the Conway and Britannia Tubular Bridges," which went through several editions; and Mr. Edwin Clark's well-known large work on the Britannia Bridge contains an interesting chapter on the tides of the Menai Straits by Mr. L. Clark. In the Appendix to the Report of the Joint Committee of the Board of Trade and Atlantic-Telegraph Company, published in 1861, is a separate Report by Mr. Clark on the subject of Telegraph Cables, &c., and the retardation of signals in long submarine cables. In 1867 he read a paper before the British Association, on "the Birmingham Wire Gauge." In 1868 he published a work on "Electrical Measurements," which has been translated both into French and Italian; and in 1871, in conjunction with Mr. R. Sabine, he published the larger and well-known work entitled "Electrical Tables and Formulæ," which is so extensively employed by electricians. In 1873 he read a paper before the Royal Society, on "A Standard Battery of Constant Electro-motive Force," describing a constant battery which had been the work of many years' experiments under his supervision; and he has read various papers before the Society of Telegraph Engineers.

In 1858 he joined the Institution of Civil Engineers as an Associate, and in 1861 he was created a Member. In 1862 he became a Fellow of the Royal Geographical Society. In 1874 he became a Fellow of the Royal Astronomical Society, and an original member of the Physical Society of London; and in the same year he was elected the fourth President of the Society of Telegraph Engineers, a post which, from his long and successful career as a telegraph engineer, Mr. Clark was justly entitled to, and during the holding of which he displayed the same assiduity, energy, and talent which have hitherto marked his character throughout, and which we trust may lead him to yet other positions of distinction and honour.

The Eastern Telegraph Company announced from advices received on the 20th ult. from Aden, that the Mauritius mail was delayed, and would probably sail on the Saturday following.

ELECTRO-MAGNETIC ACTION OF MOVED ELECTRIFIED PARTICLES.

THE name of *electric convection* has been employed by Helmholtz to denote the phenomenon which occurs in passage of a current through electrolytic liquids, consisting in the conveyance of electricity in the liquid, by motion of its ponderable carriers. According to M. Weber, the electric convection must be electro-dynamically equivalent to the flowing of the electricity in a conductor—that is, the electricity carried along by the motion of the ponderable carriers must act outwards, electro-magnetically, in the same way as the motion of the electric current in a fixed conductor. This theoretical postulate M. Rowland has recently submitted to experimental test (*Monatsbericht* of the Berlin Academy), and verified. The moved carrier of the electricity was a disc of ebonite 21.1 centimetres in diameter, and 0·5 centimetres thick. It could be rotated with high velocity round a vertical axis. The disc was gilt on both sides, but the gilding did not reach in to the axis. Close above and below this disc were two glass discs, 38·9 centimetres in diameter, perforated in the middle, to allow passage for the axis of the ebonite disc. These glass discs were also gilt in ring-like bands, and the gilt side was turned towards the ebonite disc. The gilt surfaces of the glass discs were in general connected to earth, while the ebonite disc communicated electrically by a point with one of the coats of a large insulated Leyden battery. With a a commutator, of peculiar construction, the one or the other coat could be connected with the ebonite disc or with the earth. Close above the upper disc was suspended a very sensitive astatic needle, wholly enclosed in a brass case connected to earth. Its deflections were read with mirror and telescope. It was so well protected against external electric influences, that the electric charge of the large battery and the reversal of the electrification of the ebonite disc produced no action on the needle, so long as the ebonite disc was at rest.

On the other hand, with quick rotation, even without electrification, the action of rotation-magnetism became apparent, proceeding for the most part from the brass axis of the rotating disc. The action of electrification of the disc could be separated from that of rotation-magnetism, by employing the commutator to exchange positive and negative electricity, while the velocity of rotation remained unchanged. The displacement of the needle from its position of equilibrium amounted to 5 and 7½ scale-parts; and so, its arc of swing, on reversing the electrification, was 10 to 15 parts. This result was obtained in hundreds of observations, made with continually improved apparatus during several weeks, and it was always in the same direction. The direction of deflection of the needle (whose length was at right angles to the radius of the disc), was always such as would have been produced by a positive electric current flowing with the rotation of the positively-charged disc or against the rotation of the negatively-charged disc.

There was no change in the action, when the gilding of the ebonite plate was removed in a

series of radial lines, so that ring-like electric currents could no longer occur. Also, instead of the gilt ebonite plate, a thin glass plate was used, which could be electrified with points, like the disc of a Holtz electric machine; while there was only a gilt fixed plate close under it, connected to earth, to bind as much of the electricity as possible. The direction of the deflections was the same as in the previous experiments; it was, however, less, as the conditions were not so favourable for strong electricity.

BLOCK SIGNALLING.

(Concluded from page 174.)

IT has been stated that the usual signal—that is, the signal which indicates "blocked" or "clear"—should be confirmed by a bell signal; as, for instance, when the "all-clear" signal is given, the bell code will give a certain number of beats, as indicating that signal; and the lowering of the arm—if that be the type of instrument used—will also give a similar indication. It is not sufficient that the bell signal only should be sounded, or that the semaphore arm only should be lowered, but that the one action—the lowering of the semaphore arm—should be confirmed by the number of beats on the bell which also indicate the line is clear.

All signals should be rendered as distinctly as possible, free from undue haste, and perfectly free from temper. A passionate man makes a bad signalman. Signals are frequently given and taken far too rapidly for the good working of the instruments, or for a clear understanding of what they are required to convey. For this there is no necessity. There is always ample time for all signalling purposes between the trains; and in the end it will be found that the man who does his signalling in a steady, methodical manner will will occupy less time in doing so than an intemperate man who, under some temporary irritation, works his instruments without regard to their capabilities, or to the importance of his work.

All signals should be steadily and distinctly repeated until acknowledged; and no signal should be acknowledged unless it is understood. No signal should be considered complete until it is acknowledged.

The following is a Code of Bell-signals used in conjunction with a semaphore type of instrument upon one of the most advanced railways in the kingdom:—

	Beats.	*Signals.*
1.	ONE ... o	Acknowledgment
2.	TWO ... o o	Departure
3.	TWO, given twice... o o o o	Warning (A)
4.	THREE o o o	All-clear (B)
5.	FOUR.. o o o o	Departure
6.	FIVE ... o o o o o	Departure
7.	SIX ... o o o o o o	Obstruction Danger (C)
8.	SEVEN. o o o o o o o	Error (D)
9.	EIGHT. o o o o o o o o	Attention (E)
10.	NINE... o o o o o o o o o	Testing (F)
11.	TEN. o o o o o o o o o o	Special Attention or Stop (G)

The Obstruction Danger-Signal and the Testing Signal should always be repeated in acknowledgment; the former, in consequence of its importance; the latter, because the repetition is a useful test of the instruments.

A.—The "Warning Signal" is given to the next station in advance when the departure of a train is signalled from the station in the rear. Thus the section in advance has timely notice a train is coming, and, if he has the road blocked, is able to clear it and allow the train to come on without checking it.

B.—The "All-clear Signal"—when the train has arrived, and is clear of the section, or when an Obstruction Danger-Signal has been given, and the line thereafter is all clear—is used in conjunction with the lowering of the electric arm.

C.—The "Obstruction Danger-Signal" is to be given when any necessity arises for blocking the line, either from accident, shunting, or crossing operations.

D.—The "Error Signal": given when an erroneous signal has been sent, and cancels the signal previously sent.

E.—"Attention Signal": used to call attention when a signal has not been acknowledged, or to any unusual continuance of the block.

F.—"Testing Signal": used only by telegraph inspectors, linemen, &c., to test the working of the instruments.

G.—The "Special Attention Signal" is a very important signal, and indicates something noticed wrong in a passing train which requires that train to be stopped at the station in advance.

No private signals should be allowed to be made use of on any description of block-signal instruments.

In framing a code of signals such as that quoted, it is necessary first to draw out a list of the signals required to be used. To then arrange them in their order, appropriating to those likely to be most in use the lesser number of beats; being careful, however, that the "clear" signal is not so formed that it can be produced by any foreign current—from contact, by lightning, or by the loss of a portion of another signal—for instance, if the "clear" signal were one beat only, the failure of one beat of the departure signal would produce it, the passage of an atmospheric current would also produce it, and it might be the result of a contact; but, if we make it three beats, it would be a most unusual thing for such a signal to be obtained from either lightning or contact.

The last, though perhaps not the least, points of importance in connection with this subject are: The mode of fixing the instruments in the signal-box, and that of supervision.

The instruments should be fixed in such a manner that they can be worked by the signalman without entailing upon him the inconvenience of leaving his frame or turning his back, as it were, upon his duties. A signalman's duty is to watch for approaching trains and protect them, as they arrive and depart, with the signals provided for that purpose. To enable him to do this, his signal-box is usually so arranged that—standing at his frame, ready to handle his levers—he shall have a clear view up and down the line on either side of him. His signal instruments should be fixed so that, standing in this position, he may be able to work them without leaving his post. At

the same time they should not be allowed to obstruct his view. It is not all forms of block instruments which admit of this. The needle type scarcely does so. It requires to be fixed on a counter, which is usually found at one end, or at the back, of the box; so that, for every signal given or taken, the man has to leave his post and turn his back upon his work. Spagnoletti's is also open to this objection. Walker's, Tyers's, and Preece's can be fixed in front of the man, and the two latter are usually so arranged. Tyers's are generally first fixed upon a large board, which is again fixed over and somewhat at the back of the levers. It is an obstruction to the man's view; but it is better this should be the case than that the instruments should be fixed behind the man's back. Preece's, from the fact that they are constructed in several portions, are of all forms the best adapted to this need. Really, what the man requires fixed ready to his hand, are those parts which he has to work—his bell-keys and switches. The bells may be placed overhead, or one on either side of him, so as to make the ringing more distinct; whilst the indicating portion of the instrument may occupy a small shelf at either end of the frame, but yet fully in the signalman's view. It is important that this portion of the instrument should always be under the signalman's eye, so that he may instantly note any change in it, even unaccompanied by any sound on the bell. Mr. Preece, in constructing and applying his system, has evidently had all this in view, and made his arrangements accordingly. Fixed upon a small shelf, just over the lever-handles, are the electric switches, working their miniature semaphores a mile or more away. On a facing to this board, six inches wide, are the bell-keys. On a shelf above, or at either end of the frame, are the bells and semaphores governing the roads in the direction in which they stand. The signalman never need move from his post. As he works his levers with one hand, he can work his electric signals with the other. Without shutting his eyes he cannot be off seeing any change which may be made in them. His view is uninterrupted, and he can pursue his avocation with the greatest ease and confidence. It is to be regretted, other forms of electric-signalling instruments do not admit of this convenience; but, inasmuch as it merely means the separation of the manipulating portion of the instrument from its recording portion, it is to be hoped those who are now giving so much attention to the subject will see the advantages of such an arrangement, and ere long adopt it. In the meanwhile, Mr. Preece's system has an advantage in this respect over every other system in use.

The question of block signalling is one of vast importance. It has become the backbone of railway working. Distrusted at the outset—and in some instances even cast aside as an obstruction, unreliable, and worthless—it has now assumed a position second to none as regards its utility, faithfulness, and economy. Deprived of it at this moment, many of our great lines—and more especially our metropolitan and suburban passenger traffic would be thrown into the greatest confusion. But, useful as it is, it must not be forgotten that its employment and its maintenance involve a great responsibility. Such a system should never be relied upon as perfect in itself. Regard it as an auxiliary—as one more precaution and one more protection against error—we shall do well. With perfect instruments, perfect instructions, and perfect working, it might be trusted as a principal; but such perfection, if attainable, can never be permanent. There is therefore the greater need that all who have to deal with it should pursue their duties with care and caution. A careful maintenance, and a constant and judicious supervision by intelligent officers, will not fail to bring credit—a neglect of either will end in looseness and disaster. If there is any branch of railway science which requires a thorough, careful, and intelligent supervision, it is that of which these articles have treated.

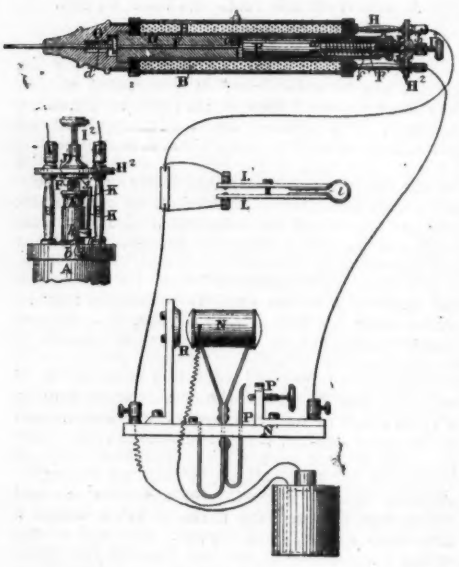
A NEW DENTAL INVENTION.

(From the "Scientific American.")

A VERY ingenious electric plugger, in which the circuit can be established or interrupted at will, has been patented (March 21, 1876) by Dr. Allen Spencer, of Columbus, Ohio. The mallet-hand piece, composed of an inner tube, is mounted in a casing. The wire of the helix is confined in the handle, and passes through the butt cap, and connects with the battery. Two cylindrical cores of soft iron are mounted in the inner tube. The core, D, is fixed, and the core, E′, movable endwise. A metallic rod plays through the fixed core; and, by the spring, *d*, pressing on a shoulder, is forced slightly beyond the inner end of the core, D, so that it may be acted upon by the movable core, E′. A tool holder is attached to the outer end of the rod, F, for the insertion of different plugger points. The movable core is pressed against a collar, *a′*, by a spiral spring, *f′*. This spring surrounds a neck, F′, and bears at one end upon the collar, *a′*, and at the other against a non-conducting ring. Two posts, H H^1, are screwed into the butt cap, and connected by a crosshead, H^2. A set screw, I^2, projects against a disc, *j*, of soft iron, around which, and between the posts, H H^1, is coiled a thin band spring, J′, of copper. One end of the spring is connected to the disc beneath the plate, and the other end to the post, H. A collar, K, on the neck of the movable core, carries an insulated break, consisting of a rod, K′, of wood, which acts on a plate spring, *k′*, secured at one end in the butt cap, *b*, by a screw communicating with one end of the helix wire, the other end of the helix wire being connected with the insulated post, H^1. The outer end of the spring, *k′*, abuts against the guide, *k*, which forms a contact stop. A simple circuit break or key, which may be operated by the mouth, or preferably by the foot, is connected with one of the battery wires, sufficient length of wire being employed, as shown, when the key is used, to admit of its ready manipulation by the operator. It is composed of two rubber sides, L L′, connected by a spring, *l*, at the rear, so as to admit of the sides of the key being pressed toward each other at their outer ends.

In operation, the armatures, D D′, being mag-

netised, the sliding one, E′, carries down the disc, *i*, until the endwise-moving break rod, K′, strikes the spring, *k′*, breaking the circuit and interrupting the current at the same time that the hammer-like stroke of the moving core upon the shaft, F, operates the plugger point. The cores being demagnetised by the breaking of the circuit, the moving one is quickly returned by its spring, *f′*, to its normal position, closing the circuit; and the shaft also, at the same time, is protruded beyond the end of the fixed core, D, retracting the plugger point with it. The above operation is repeated and continues as long as the break key closes the circuit. In this way the operator has complete control over the instrument. The battery is, by preference, provided with a vibrator to cause the current to pulsate. The vibrator is shown as mounted in a cylinder, N, supported upon the battery cover or box, N′.



When the connections are all made and the vibrator is started by hand, the motion becomes self-sustaining because of the impulse given the spool magnet by its attraction toward the disc, R, at every pulsation of the current; and as the pulsations pass by the wires through the cores, D E′, of the mallet, they become magnetised, and the plugger point strikes its blow. The speed of the pulsations is controlled by the thumbscrew, P′; when the screw is set toward the spring, P, the vibrations are more rapid, and when set further off they become slower. The set screw of the vibrator serves also to regulate the force of the blow by determining the instant at which, with reference to the stroke of the mallet, the circuit shall be broken; whereas the set screw, I², of the automatic break, serves merely to regulate the frequency of the blows.

ON MEASUREMENT OF THE ELECTRIC RESISTANCE OF LIQUIDS BY MEANS OF THE CAPILLARY ELECTROMETER.

IN the ordinary methods for measuring the resistance of liquids, one operates (it is known) not on a simple liquid column, but on the complex system formed by the liquids and by the electrodes which bring the current. The polarisation of these electrodes intervenes in each experiment, but it is taken account of by means of double experiments. M. Lippman has submitted to the French Academy a method which requires only one simple experiment; it is independent of the polarisation of the electrodes.

The equality of two resistances *r*, *r′* (he says) may be recognised by means of the law of Ohm-Kirchoff; the resistances being placed in the same battery-circuit, if it be found, with a sensitive electrometer, that the difference of potentials at the extremities of *r* is equal to the difference of potentials at the extremities of *r′*, one may conclude that *r* is equal to *r′*. In our experiments *r* is the resistance to be measured; *r′* is a graduated scale of metallic resistances. The liquid to be operated upon is contained in a cylindrical glass tube terminated by two metallic electrodes which bring the current; these electrodes are plane and perpendicular to the axis of the tube, so that the equi-potential surfaces of the tube may be parallel to them. Two fine holes *p p′* are made in the tube for putting the corresponding points of the liquid column in communication with the poles of a capillary electrometer; by means of a cup-commutator, the poles of the electrometer may be connected necessively with *p*, *p′* or with the extremities of a box of graduated resistances *r′*. The current of a Bunsen element is passed through the tube full of liquid and the box *r′*. We open the resistances in this box, until, on moving the commutator, we no longer produce any variation in the position of the index of the electrometer. At this point, the sum of the resistances opened in *r′* is equal to the resistance of the liquid column contained in the tube, and comprised between two straight sections at the points *p* and *p′*: it will be observed (and this is the important point) that this liquid column *p p′* does not contain any electrode traversed by the current. It is the middle portion of a homogeneous liquid column. Polarisation does not intervene. The electric communication between the points *p p′* and the poles of the electrometer is established by means of lateral ajutages cemented to the glass tube, filled with the same liquid as the tube, and in contact with electrodes like those of Du Bois-Raymond. These compound electrodes are more convenient than the simple ones, because of their constancy; they do not here serve to obviate polarisation by the current of the battery, for this current does not traverse them. Before and after each determination, we verify directly with the electrometer, that they do not present an electric difference equal to $\frac{1}{1000}$ of an element of sulphate of copper. The numerical results furnished by the method are of great precision.

The use of the electrometer has a special advantage in the measurement of great resistances; it is, that the sensibility does not diminish even

when the resistance is indefinitely increased. Where it is desired to observe quick variations of resistances, the capillary electrometer has further the advantage that the movements of the mercury index are aperiodic and sensibly instantaneous. It has thus been observed that the electric conductivity of a wire placed in a bobbin of iron varies suddenly at the moment of making and of breaking the current in this bobbin. Similarly, it has been directly ascertained that the action of light on the conductivity of selenium is sensibly instantaneous. The mercury column of the electrometer is suddenly displaced every time you intercept or admit the ray of sunlight. The actions of magnetism and of light being instantaneous, one may conclude that they are not due to variations of temperature.

Notes.

The President of the Royal Society (Dr. Hooker), Mr. Spottiswoode, Dr. Burdon Sanderson, and Dr. Siemens had an interview, on the 17th ult., with the Lord President of the Council, the Duke of Richmond and Gordon, and presented to him a memorial in favour of the establishment of a Museum of Pure and Applied Science. The memorial was numerously signed by gentlemen who have been connected with the Loan Collection of Scientific Apparatus at South Kensington. The memorialists defined the proposed museum as one "to contain scientific apparatus, appliances, and chemical products, illustrating both the history and the latest developments of science; where the methods and results of investigations which have marked important stages in the advancement of science may be studied, and where also the most highly perfected instruments of the day may be found." His Grace discussed the subject with the deputation, and stated that he would consult his colleagues.

Professor Gladstone lectured recently at South Kensington on the instruments of Davy and Faraday; the instruments, sent by the Royal Institution to the Loan Collection, being displayed in the lecture-room, and a brief account given of the work done with them. Among the Davy relics were a number of early forms of the Davy lamp; and his voltaic battery, now too corroded for use, was shown.

The superintendent of the Italian experimental silkworm farm at Padua has found that the hatching of silkworms may be accelerated by ten or twelve days, and a yield of 40 per cent. of caterpillars secured, by exposing the eggs to a current of negative electricity from a Holtz machine for eight or ten minutes. It is suggested to apply the method to hens' eggs, and to hasten the germination of seeds.

Sir Robert Christison, Bart., recently read a paper before the members of the Botanical Society in Edinburgh, in which he described some observations he had made on an ash-tree near Dean Bank Toll, which was struck with lightning in 1874. This tree (one of a row) was about 30 feet from those nearest to it. It was for the most part exposed on the west side, and when, during the storm, it was struck by the lightning, this side suffered most from the electric fluid, which stripped off the bark and made two long narrow fissures in the trunk. In the spring of last year, but some fourteen days after the other ash-trees in the row had began to bud, this one put on some buds. On the west side, however, where the electric fluid had taken most effect, not a single bud was visible. At the present time the great bulk of the foliage on the tree is very thin, and during the last three weeks it has made no progress. Sir Robert had spoken to the owners with regard to the purchase of the tree for botanical purposes, and found that they were favourable. He thought, however, before it was got, some further time should be given it in order that its further progress in the way of vegetation might be watched. At the conclusion of the paper, Mr. Potts called attention to a curious incident which occured two years ago at Lasswade Loan, when a flash of lightning ran along the telegraph wire, whose connecting poles were parallel to a row of ash and elm-trees, and the lightning, strange to say, passed the elm-trees and split the ash-trees. Sir Robert Christison said, in reference to Mr. Potts' remarks, that even in the days of Shakespeare there was a belief that some trees were more likely to be struck than others, and he believed the ash was one of these.

Prizes are offered by the Netherlands Scientific Society, Haarlem, for essays on the following (among other) subjects:—1. Complete experimental study of the possibility of decomposing water by a Daniel's cell. 2. The meteorological and magnetical phenomena which can be shown to be in connection with the solar spots.

During a severe thunderstorm on the night of Monday, 17th ultimo, Bishopston Church and Wilmcote Church, Stratford-on-Avon, were struck by lightning, and great portions of the roofs of both buildings were torn off. Several persons who had taken refuge in the churches were severely injured by the falling *debris* and the electric fluid.

On Saturday afternoon, 22nd July, a thunderstorm broke with great violence over Retford. A flash of lightning was seen to strike the Union Workhouse, and the roof of the building was quickly in flames. An alarm was raised, and the fire brigade was soon at work; but by this time the fire had caught a quantity of straw, and it was not extinguished till a part of the building had been completely gutted. Several trees were struck, and a sheep was killed in one of the fields. The crops suffered severely.

According to a published report on the climate of central and tropical Australia, by Mr. Giles, (who had charge for several years of the Telegraph Station at the Charlotte Waters), thunderstorms are there of daily occurrence in the summer season, and are often very violent. They rarely occur in the forenoon. Dry thunderstorms are frequent, occurring usually at night, and during great heat. In one instance of the kind, the thermometer stood at 103° at midnight, and an intensely hot wind blew from the north. The sky is generally covered with detached masses of cirro-cumulo-stratus, and the heavens are wrapt in an almost unceasing blaze. There is little thunder, and the discharges are from cloud to cloud only. Mr. Giles thinks the thunderstorms in this region inferior in intensity to those of more southerly latitudes. The detonations are not nearly so tremendous; and he had not noticed lightning in the form popularly known as a thunderbolt.

A comprehensive system of meteorological observation has been in course of organisation in South Australia, and on completion of the telegraph to Western Australia, now being constructed, the observer in Adelaide will possess the means of knowing the prevailing state of the weather each day nearly all round the seaboard of Australia, information which, if rightly used and interpreted, cannot fail to be most useful.

At Newmarket, N. H. (according to the *Journal of the Telegraph*), a telegraph operator recently had one of his thumbs taken off by a stroke of lightning while manipulating the key. A lady-operator in the Exeter Depot, on the same line, received a severe shock and was rendered deaf in one ear. The plastering from the ceiling of the office was scattered about the room.

Among the apparatus now on view in the Centennial Exhibition, is an ingenious contrivance for providing the weather necessary to work various instruments used in meteorology. It includes a shower-bath to produce an artificial rain-storm, and a fan-blast, which generates gales of any force from ten to sixty miles an hour.

The phenomena of Geissler tubes have lately been occupying the attention of MM. Reitlinger and Urbanitsky, of the Vienna Academy. The action of the magnet causes a regular and calculable increase of the luminous layers and this action is in direct ratio of the magnet's force. The additional layers seem to flow from the positive electrode. Besides the well known fluorescence of the glass of Geissler tubes during passage of the induction current, one may observe a second light-phenomenon, inherent in the glass, arising from a different mode of action of the columns of conducting gas. The authors have studied the phenomena of fluorescence in Geissler tubes enclosed concentrically in larger glass tubes, the intervals between the tubes being filled with an alcoholic solution of sulphate of quinine with excess of acid. The combined action of magnetism and the distributive force of a steel magnet proves that the conductors in proximity to the tubes cause not only an *attraction*, as has been believed hitherto, but also a *repulsion* of the columns of luminous gas. These repulsions are accompanied by the appearance of light different from fluorescence on the part of the glass opposite to the approximated conductor—*e.g.*, to a finger of the experimenter. In certain circumstances, it suffices to bring the finger near the glass without touching it, to produce repulsion of the luminous gas. There is, then, in this case, an action at a distance.

A curious Japanese compass, taken out of the wreck of a junk at the entrance to Yokohama Bay, has been described by Mr. Frank Buckland in *Land and Water*. It is of circular form, measuring 13½ inches across, cast in bronze, and weighs 21 lbs. It has a thick rim, in which two ordinary compasses are set, one on each side. The centre of this remarkable plate-looking object is considerably raised from the surface, and is covered with a number of raised spots or stars of various sizes, each more or less connected by lines with its neighbours. The shapes of these star-like objects is remarkable. In the centre there are five which are larger than the rest. Then there is another group very like a net; another group represents almost a complete circle of these stars; another represents a Y with the arms closed together; another a Y with the arms extended. Altogether there are no less than two or three hundred of these elevated spots of different sizes. Running throughout the whole series are several lines radiating from a circle drawn round the centre. The brass rim on which the compasses are set is divided into 360 degrees, the same as an English

compass. At every 30 degrees there is a Japanese character. Neither Captain Murray, who obtained the compass from a pilot, nor anyone who has seen the curiosity, can divine the meaning of the star-like bodies in the centre, or for what purpose the Japanese used them. It is most interesting that these rude characters should be united in the same instrument with the 360 degrees of modern civilisation. The casting of this remarkable instrument is very marvellous. An optician who cleaned it up for Captain Murray in Glasgow, said he had never seen a finer bit of work. Mr. Buckland hopes to call the attention of some gentlemen who are learned in astronomy to this compass, and, if possible, get an explanation of its use in Japanese navigation.

The estimated gross receipts of the Anglo-American Telegraph Company were on July 14th, £1,250; 15th, £1,180; 16th, £270; 17th, £990; 18th, £1,310; 19th, £1,240; 20th, £1,410.

The traffic receipts of the Direct United States Cable Company, at 3s. per word, for the week ending 15th ult., were £2,850.

The Pernambuco and Bahia section of the Western and Brazilian Telegraph Company was repaired on the 15th ult., thus restoring direct communication with all South American Stations. On July 21st, the same Company received intimation of an interruption on the Bahia-Rio de Janeiro section of their cables. The repairing steamer would be on the spot in a few days, and as there are frequent steamers between these ports, the delay to messages was not likely to exceed a few days.

The report of the Globe Telegraph and Trust Company for the year ending 18th inst. shows a net revenue of £146,374, which with £9,327, brought forward, leaves a sum available for distribution of £155,700. The interim dividends paid have absorbed £114,385, to the expenses of formation £1,000 is credited, and the proposed dividend of 3s. on the preference, and 2s. on the ordinary shares requires £36,572, leaving £3,743 to be carried forward.

Electrical Science in Foreign Journals.

Comptes Rendus of Paris Academy. Vol. 83, No. 1: 3rd July, 1876.

Third Note on Electric Transmissions through the Ground. By M. Du. Moncel.—We hope to recur to this.

Automatic Discharger for Electro-Atmospheric Rods. By M. Serra Carpi.

This consists of a copper lever 30 centimetres long, with equal arms, turning about a pivot in communication with the part of the conductor which carries the discharge to the ground. At one end of it is a gilt ball, situated 5 centimetres from the end of the insulated conductor; the other end is fitted with a piece of soft iron. When the end of the lever has acquired sufficient tension to produce small sparks, attraction occurs between the gilt ball and the end of the insulated rod; so that the lever turning on its pivot, comes into contact with the rod. That this contact may be maintained, spite of wind and other disturbing causes, a small magnet is so placed, that when the first contact takes place between the lever and the rod of the conductor, a second occurs between the magnet and the other arm of the lever. The magnet should be so strong as to maintain the attraction by contact without attracting at a certain distance. This can be effected with an armature or a screw movement. The lever turns only in one direction, and it can be made immovable in case of a special observation. This apparatus has been tried at Rome during thunderstorms. Whenever the rod acquired a tension capable of producing sparks of two to three metres, it came automatically into communication with the ground, and the lever remained in contact with sufficient force for ordinary disturbing causes.

New Peroxide of Manganese Battery. By M. Leclanché.

If the depolarising mass (of peroxide of manganese and carbon), be submitted to considerable pressure—several thousand kilogrammes per square centimetre—it is made much more conductive, and so gives much more electricity in unit time. Some matter being added that will solder the parts together, a solid, homogeneous, resistant mass is had, of true metallic conductivity. M. Leclanché gets the best results with a mixture containing 40 per cent. peroxide of manganese, 55 per cent. of retort carbon, and 5 per cent. gum lac resin. It is put in a steel mould, heated to 100 degrees, and subjected to hydraulic pressure. He has had more than 30,000 elements made thus, which are now in use on the railways. The addition of 3 or 4 per cent. of bisulphate of potash in the interior of the agglomerated mass contributes to diminish its resistance considerably by dissolving the oxychlorides, which, in course of time, are deposited in the pores. The force of the new battery is about 1·5, compared with a Daniell taken as unity.

No. 2: 10th July.

Experimental Researches on Magnetic Rotatory Polarisation. Third Part: *Dispersion of the Planes of Polarisation of Luminous Rays of different Wave-lengths.* By M. Henri Becquerel. (Extract from Memoir.)

He gives a table of results with various diamagnetic and magnetic substances. The positive rotationn (by the former) of the planes of polarisation increase approximately in inverse ratio of the squares of the wave-lengths. Taking the indices of refraction into account, the exceptions to the law are explained. The negative rotations by magnetic bodies (bi-chloride of titanium is a good example), follow a different course, and correspond to a large rotatory dispersion; they increase, approximately, in inverse ratio of the

fourth power of the wave-lengths. The great rotatory dispersion of per-chloride of iron may be easily shown, if a solution be taken which has a very weak positive or negative rotation for yellow light (*e.g.*, one of density 1·155). The same solution is then found positive for red rays and negative for green. The phenomenon of magnetic rotation is shown to be a function at once of the wave-length, the index of refraction, and the nature of the molecules, of bodies. One of the simplest expressions for the magnetic rotatory dispersion of bodies, is $\frac{a}{\lambda^2} + \frac{b}{\lambda^4}$, a and b being co-efficients, the sign and numerical value of which vary with different bodies; a is relatively large and positive for very diamagnetic bodies, b large and negative for very magnetic bodies.

On the Difference of Potential in the Insulated Extremities of an Open Induction Bobbin, after Rupture of the Inducing Current. By M. MOUTON. HE had formerly shown that this difference, immediately after rupture, increases, reaches a maximum, diminishes, and falls to zero again, changes sign and returns to zero, and thus oscillates for some time about zero. He here studies the values of these differences of tension. When the induced bobbin is formed of only one part, so that one end of the wire is in the interior of the rolled mass, and the other without, the former remains throughout at a potential almost *nil;* the difference measured thus representing entirely the potential of the exterior pole. If the bobbin consists of two similar bobbins, connected either by their interior or their exterior extremity, the two free poles have, each instant, equal potentials, of contrary sign. *Inter alia*, the values of the first maximum increase more quickly than in proportion to the intensity of the inducing current (where this is changed), and to the number of layers of spirals (where this is changed). The introduction of ten pieces of soft iron raised the first maximum from 18 to 50. The maxima diminish pretty slowly during the oscillatory period.

Influence of Fatigue on the Variations of the Electric State of Muscles during Artificial Tetanus. By MM. MORAT and TOUSSAINT.

CONSIDERING modifications of the electric state of muscles, two types of artificial tetanus may be distinguished; one in which the shocks are so perfectly fused as to be almost invisible in the muscle-curve, but the value of the negative variation undergoes, at each shock, oscillations capable of inducing a secondary tetanus. This type may be regarded as a tetanus still imperfect. In the other type, not only are the shocks fused, but the negative variation is brought to a value nearly constant. This is perfect tetanus; that which the indications of the galvanoscopic limb show to be similar to voluntary contraction.

MONATSBERICHT OF BERLIN ACADEMY. DECEMBER, 1875.

On the Velocity of Propagation of Electricity in Telegraph Lines. By DR. WERNER SIEMENS.

THE method consisted in employment of two Leyden jars, or charge-tables; one coat of one of these was connected directly, by a short wire and one of the other by a long telegraph line, (going and returning), with a point which stood opposite to a rotating, smoked steel cylinder connected to earth. The outer insulated coats of the jars were connected together metallically. On connecting them to earth, the electricity of the inner coats is liberated and discharges itself to earth through the point and the rotating cylinder. If the rotation be fast enough and the line long enough, two marks appear on the cylinder separated by an interval, which measures the time taken by the electricity to pass from jar to point through the line. (Some modifications of this method, and also further details, are described in the paper.) Dr. Siemens concludes from his experiments, that the propagation of electricity in conductors takes place with a determinate velocity, not dependent on the length of these; in iron wires this velocity is between 30 and 35,000 miles per second. From these experiments and others with a caoutchouc tube filled with liquid, (zinc vitriol solution), he also infers that the actual velocity of electricity is immeasurably great, and that the retardations observed by Wheatstone, Fizeau, and others, were entirely due to "jar-action" of the overground lines. (The velocity in liquids he concluded to be over 800 geographical miles per second). He thinks it likely that the velocity in metallic conductors depends on the nature of the conductor, and was purposing experiment on this.

JOURNAL TELEGRAPHIQUE. No. 18: 25TH JUNE, 1876.

General Considerations on Telegraphic Tariffs. By M. VINCHENT.

HE considers Governmental monopoly justified by the experience of certain states (England and United States), and by the necessity of finding resources in good lines, to extend the institution into parts of the country where it cannot yield any profit. The question, "Is monopoly always a cause of rise of tariff, and competition always a cause of cheapness?" he answers in the negative, and cites cases. The solution given of these two questions does not apply to submarine lines. Still, he thinks a conditional monopoly in this case better than indefinite competition.

The Automatic Printer Apparatus of M. Olsen.—Reserved for separate notice.

Mathematical Determination of the Points of Derivation of Telegraph Lines. By M. SCHENCK.

SUBMARINE TELEGRAPHY.

FROM 1850 to the end of 1874, the number of telegraphic cables actually submerged was 206, representing a length of 80,000 kilometres (about 49,000 miles). Of these 206 cables sixty-one have ceased to be of any use, and 145 are still working. England and France are the two countries which possess the most submarine cables. England has twenty-nine and France sixteen. France and England are themselves bound together by seven telegraph cables.

In 1850 and 1851 but two submarine cables were laid down. This magnificent enterprise

was then in its infancy. In 1852 and 1853 eight cables were immersed, in 1854 seven, and 1855 nine, in 1856 and 1857 one each year, in 1858 five, in 1859 thirteen, in 1860 twelve, in 1861 one, in 1862 two, in 1863 one, in 1864 six, in 1865 three, in 1866 ten, in 1867 seven, in 1868 two, in 1868 two, in 1869 seventeen, in 1870 twenty-seven, in 1871 twenty-six, in 1873 fourteen, and in 1874 thirteen.

Among the longest of these submarine cables, is that which runs from Ireland to the American coast of Newfoundland, which measures 1920 miles; the cable from Ireland to the coast of St. Vincent at Pernambuco measures about 1950 miles, and that from Brest to St. Pierre about 2570 miles. France, therefore, has laid beneath the sea the longest cable known.

The greatest depth of immersion of cables is as follows: The cable between Malta and Alexandria lies at a depth of 13,800 ft.; that between Ireland and Newfoundland, 17,700 ft.; that between Portkarno, in England, and Lisbon, 18,000 ft.; that between Brest and St. Pierre, 11,370 ft. Before 1851, the era when the first transatlantic cable was laid, no cable of a greater length than 350 miles was in existence. After having been in use but a month, the first transatlantic cable broke. This was a serious check; but it had been proved that the ocean could be spanned by an electric wire.

The conception of the project of a trans-oceanic telegraph is due to an ingenious American, Mr. Cyrus W. Field, to whom, in 1864, the Congress of the United States gave a vote of thanks and a gold medal. He also obtained the "*grand prix*" at the International Exposition of Paris in 1867.

It was not until 1870 and 1871 that direct communications were established between England, India, China, Japan, and Australia. At present it only needs to lay a cable at the bottom of the Pacific Ocean in order to surround the world with a complete *ceinture* of electric telegraphy, according to the dream of Mr. Cyrus Field. The total length of the Pacific cable would be about 5540 miles, divided into three sections—First, from San Francisco to Honolulu, 2087 miles; Honolulu to Midway Island, 1164 miles; from the last-mentioned to Yokohama, 2289 miles.

Eleven new cables are at the present writing in course of construction, having a total length of 17,000 miles. The largest ones will connect Ireland and New Caledonia, 2188 miles; Aden and the Mauritius, 2777 miles; and Honolulu and the Fiji Islands, 2876 miles. The strength and endurance of submarine cables depends upon the depths to which they are submerged and the nature of the ocean bottom upon which they rest. If there are rapid currents and a rocky bottom, the cable must be very solid and heavy. The cables of the Anglo-American Company cost 5,000 francs per kilometre (.62 of a mile) for those which lie in the depths of the ocean, but those for nearer shore cost 16,000 francs per kilometre. The cables between England and Holland are constructed almost through their entire length on the model of the in-shore transatlantic cables, because the water the whole distance is comparashallow, and never exceeds thirty fathoms. Of course, their cost was heavy.

There are sixteen companies of submarine telegraphy, with a capital of upwards of 500,000,000f. The principal is the Anglo-American Company, which possessess five cables and a capital of 175,000,000f. The Eastern Submarine Telegraph Company has a capital of 75,000,000f. The West India and Panama Company has a capital of 47,500,000f. The Eastern Extension, Australia and China, has a capital of 41,500,000f. The Western and Brazilian has a capital of 33,500,000f. There can be little doubt that the tendency of the times is to the unification of the telegraphs under the governments of the respective countries wherein they are located. The vast extension of telegraph cables leads to the expectation that a still further consolidation of interests will be effected, and the telegraphs of the world will finally be placed under the control of an international commission.—*From "L'Electricité."*

PATENTS.

2395. H. ADRIEN, Paris and London. Dated July 1, 1875. (A communication).—"Certain improvements in electro-magnetic telegraphs, where induced currents are used, and also in apparatus for producing such induced currents." The invention consists in combining induction coils with a non-conducting and a conducting surface, with a battery in line of a telegraph, and a chemical writing instrument, with local batteries and electromagnets, or with a needle telegraph, in such a manner that a constant current of electricity of either kind can be produced, that a continuous line will be drawn on the paper by the action of the line battery current, that a despatch transmitted to the receiving station over the main line will be transmitted over an additional line without the aid of an operator, or that whenever a signal is sent over a main line, clear and distinct marks are obtained for each signal, however feeble.

2410. F. CHAUVIN, L. GOIZET, and A. AUBRY, Paris. Dated July 3, 1875.—"An improved electric submerged lamp." A balloon-shaped glass vessel protected by a metal cage is hermetically closed, preferably by an india-rubber plug. The plug is traversed by two metal rods isolated electrically. At the ends of these rods the two ends of a platinum thread, rolled into a spiral, are fixed, which, when traversed by the electric current, is heated to incandescence, and emits light. The generating current is contained in a separate box.

2434. W. STROUDLY and S. RUSBRIDGE, Brighton. Dated July 6, 1875.—"Improvements in apparatus for, and in the method of signalling between parts of a railway train, parts of which are applicable to or for other purposes." In each guard's van, and on the engine or tender when desired, is an electromagnetic "chattering" bell-signal, fitted with a novel double action pull apparatus. A knob, key, or plunger, on being depressed or pulled out, makes contact and calls or signals on the bell, either a series of separate blows or signals, or on being pressed or kept in action produces a continuous series of signals; and added to such knob or button, a sliding guard-screen or cover plate, which, slid behind, maintains it under pressure or in contact, when pulled out; the bell thus rings continu-

ously, while the guard is free for other duties. By pulling a line, a passenger may ring simultaneously the bell in each break-van or on the engine. The bell instruments are electrically connected together by a line wire, or by circuit line wires, or by a line wire and earth circuit jointly produced by the connection through the wheels. In each compartment is a knob or key, which, on being drawn out, causes the bell to ring, and remains locked till the guard comes and unlocks it. It may also be made to raise an externally visible signal-arm, disc, or semaphore.

2,509. W. R. LAKE, London. Dated July 12th, 1875. (A communication).—"Improvements in galvanic apparatus, and in contrivances connected therewith, applicable to telegraphic and lighting purposes." This is, first, for pneumatic telegraphic alarms and signals, for short distances, such as for hotels or houses; second, for lighting chandeliers having a single gas burner; third, lighting chandeliers which have several burners.

2,564. T. A. HEQUET, Paris. Dated July 17th, 1875.—"Improvements in electro-magnets." This consists in dividing the yoke which joins the bobbins of electro-magnets, or magnetically insulating the bobbin cores, so as to suppress residuary magnetism, means being applied by sliding the yoke or cores, of rendering the insulation greater or less, the object being to render the vibrations of the armatures of electro-magnets more equal and precise.

2,657. W. CLARK, London. Dated July 23, 1875. A communication).—"Improvements in circuit-closers for electric railway-signalling apparatus." The object of this invention is to utilise the proportionate elasticity of railway rails in connection with the weight of trains passing over the same, for the purpose of establishing electrical connection for operating suitable signals.

2707. W. M. WARDEN, S. MUIRHEAD, and J. L. CLARK, Westminster. Dated July 27th, 1875.—"Improvements in galvanic batteries." This relates to those batteries in which the negative element is surrounded with manganese.

2,729. C. E. WETTON, Harrow. Dated August 8, 1875.—"Improvements in magnetic apparatus, and its application to various purposes." A united magnetic and electric action is produced by means of a disc of silver and another of zinc, adapted and applied to the ordinary magnetic appliance. Also, magnets are fitted and arranged in such a manner as when applied to the body they are covered externally by a non-conducting material.

2,771. SIR C. WHEATSTONE. Dated August 5th, 1875.—"Improvements in the mode of, and apparatus for, applying electricity to give telegraphic signals, and work telegraphic relays." This consists in employing for telegraphic signals the motions produced when mercury is in contact with an electrolytic liquid within a tube of narrow calibre, and electric currents are transmitted through them; also in employing said motions for completing one or more local circuits by which a telegraphic instrument may be brought into action by means of electric currents transmitted through the main circuit.

2,786. C. A. McEVOY, Southwark. Dated August 7, 1875.—"Improvements in firing and in giving motion to torpedoes, part of which invention is also applicable to propelling other floating bodies." This provisional specification describes various fuses, electrical ones to be worked from the shore or from a torpedo boat, or by percussion, and also mechanical percussion ones.

2,787. J. H. JOHNSON, London.—"Improvements in producing electric-signals, fires, and lights, and in the apparatus employed therein." Dated August 7th, 1875. (A communication).—The apparatus used to complete a set of signals consists of a distributor or divider, a commutator, and the lamps. The distributor consists of a cylinder of non-conducting material, carrying a number of pieces of metal provided each with two projecting arms, which as the cylinder rotates dip into troughs containing mercury, for the purpose of transmitting the current of electricity from the battery to the commutator, with which the troughs are in communication. The commutator consists of three cylinders capable of occupying different positions, and provided with suitable contact pieces for conducting the current of electricity to any one or more of the lamps, according to the signal to be given. The lamps are constructed in such a way as that one of their electrodes is animated by a rapid vibratory motion, in such a manner that if the electrodes are in the illuminating current a spark will be produced at each contact.

2,803. R. MORLEY, London.—"Improvements in electric telegraphs." Dated August 9th, 1875. (A communication).—This invention has for its object to avoid the unevenness and spreading of colour in the signs made on chemically-prepared paper in some automatic telegraphs. It does so by discharging a battery upon the receiving apparatus at the same time that the line is traversed by currents from two batteries alternately positive and negative. An arrangement is also described for transmitting signals at a high rate of speed at the same time in opposite directions over one wire.

Correspondence.

To the Editor of the TELEGRAPHIC JOURNAL.

SIR,—I notice in your issue of the 15th inst. a review on some portion of the contents of No. 11, Vol. IV., of *The Journal of the Society of Telegraph Engineers*, and noticing some remarks on a communication by a Mr. Edison, on the imperfect contacts which occur in signalling with *rigid points* by a Bain's printer—please do me the justice by permitting me, through the columns of your journal, to say that a *non-rigid* stylus, made from No. 30 wire, and about one inch in length, was used by me, assisted by Professor Farmer, on the 19th August, 1870, on a line built for my system between the cities of Washington and New York, since which time *non-rigid* styluses have always been used in connection with my apparatus for cheap telegraphy, and clearly shown in my English patent, of date April 22nd, 1872, at letter *i*, fig. 19, sheet 8; as also in my American patent of September 2nd, 1873, at fig. 23, sheet 3.

Yours truly,

GEO. LITTLE,

June 30, 1876. Richmond, Va., U.S.